The Distribution of Wealth and the MPC: Implications of New European Data

December 12, 2013

Preliminary

Christopher D. Carroll[1] JHU

Jiri Slacalek[2] ECB

Kiichi Tokuoka[3] MoF, Japan

Abstract

Using new micro data on household wealth from fifteen European countries, we first document the substantial cross-country variation in how various measures of wealth are distributed across individual households. Through the lens of a standard, realistically calibrated model of buffer-stock saving with transitory and permanent income shocks we then study how cross-country differences in the wealth distribution and household income dynamics affect the marginal propensity to consume out of transitory shocks (MPC). We find that the aggregate consumption response ranges between 0.1 and 0.4 and is stronger (i) in economies with large wealth inequality, where a larger proportion of households has little wealth, (ii) under larger transitory income shocks and (iii) when we consider households only use liquid assets (rather than net wealth) to smooth consumption.

Keywords Marginal Propensity to Consume, Wealth Distribution, Liquid Assets, Cross-Country Comparisons

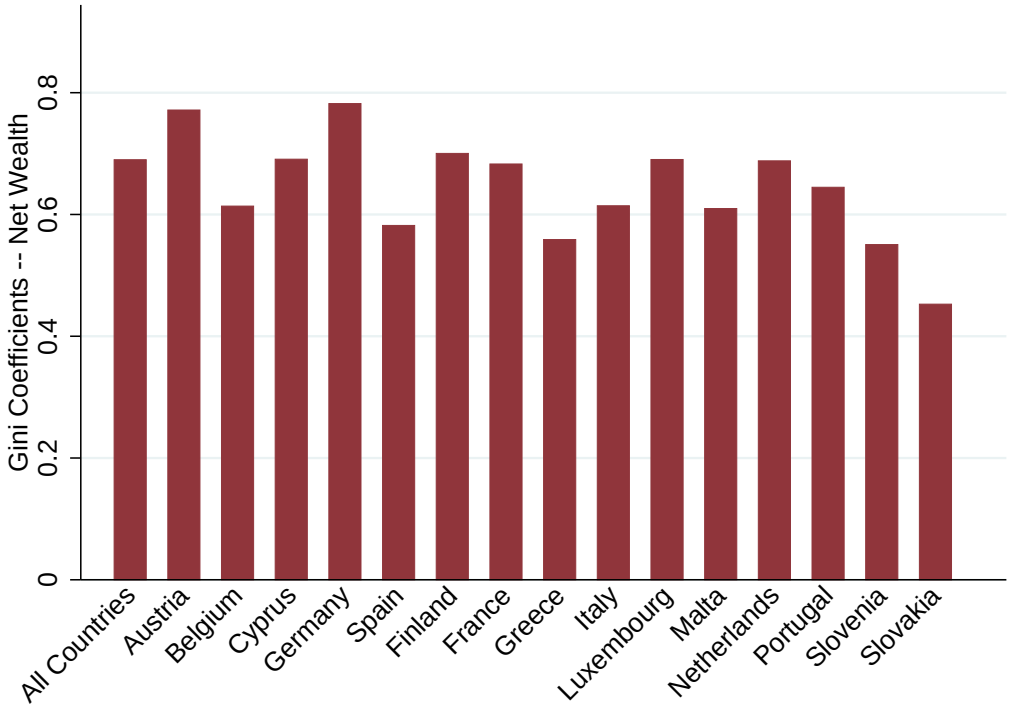
JEL codes D12, D31, D91, E21

PDF: http://econ.jhu.edu/people/ccarroll/papers/cstMPCxc.pdf
Slides: http://econ.jhu.edu/people/ccarroll/papers/cstMPCxc-Slides.pdf
Web: http://econ.jhu.edu/people/ccarroll/papers/cstMPCxc/
Archive: http://econ.jhu.edu/people/ccarroll/papers/cstMPCxc.zip

[1]Carroll: Department of Economics, Johns Hopkins University, Baltimore, MD, http://econ.jhu.edu/people/ccarroll/, ccarroll@jhu.edu [2]Slacalek: European Central Bank, Frankfurt am Main, Germany, http://www.slacalek.com/, jiri.slacalek@ecb.europa.eu [3]Tokuoka: Ministry of Finance, Tokyo, Japan, kiichi.tokuoka@mof.go.jp

We thank participants in the European Central Bank Conference on Household Finance and Consumption for helpful comments. The views presented in this paper are those of the authors, and should not be attributed to the European Central Bank or the Japanese Ministry of Finance.

Figure 1 The Gini Coefficients for Net Wealth



Source: The Eurosystem Household Finance and Consumption Survey.

Notes: The figure shows the Gini coefficient for net wealth, defined as the sum of real assets (including housing) and financial assets, net of total liabilities. The data cover the following countries: Austria, Belgium, Cyprus, Germany, Spain, Finland, France, Greece, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovenia and Slovakia. Reference year: mostly 2010; see Eurosystem Household Finance and Consumption Network (2013b), Table 9.1. The Gini coefficient for 'All Countries' was calculated by aggregating household-level data country by country using estimation weights (which give the number of households in the population each observation represents).

1 Introduction

We are only beginning to understand the implications of household heterogeneity for behavior of households and economies. For example, holdings of wealth are known to vary considerably across households. This paper quantifies how the distribution of wealth at the micro level affects the behavior of consumption across developed economies.

While we know from the Survey of Consumer Finances that, in the US, wealth is considerably more unevenly distributed than income, the relevant stylized facts from other countries—which differ substantially in institutional settings, such as the systems of taxes and social benefits, pension systems, health care and the home-ownership rate—have until recently been scarce. Using data from the newly released "Household Finance and Consumption Survey," Figure 1 documents that wealth inequality, measured with

the Gini coefficient, varies considerably across European countries, roughly between 0.45 and 0.8; the latter value broadly comparable with the data for the US.[1, 2]

This paper explores the implications of wealth and income heterogeneity for consumption dynamics using the model of Carroll, Slacalek, and Tokuoka (2013b) with realistic income dynamics with permanent and transitory shocks, calibrated to the empirical wealth distributions across different countries. The precautionary saving motive generates a substantial non-linearity in the consumption function, which in turn implies that the marginal propensities to consume (MPC) of individual households differ significantly depending on how much wealth they own. Consequently, the distribution of wealth has a considerable impact on the response of aggregate consumption to shocks. In particular, the substantial proportion of wealth-poor households, which are not adequately insured, increases the aggregate MPC to around 0.1–0.4, a range broadly in line with the empirical evidence from micro data. Our estimates suggest that the aggregate MPCs in European countries are somewhat lower than in the US because European households tend to hold more wealth and because wealth is more equally distributed.

We explore two aspects of heterogeneity: the wealth distribution and household-level income uncertainty. The wealth distribution in our model affects the MPC through level and through inequality, as captured in the Gini coefficient. Countries in which households tend to hold less wealth respond more strongly to transitory income shocks. Similarly, countries with more pronounced wealth inequality have a higher aggregate MPC and also a larger dispersion of MPCs across households.

Household-level income dynamics affect the aggregate MPC mainly through the size of transitory shocks, against which households can better insure themselves than against permanent shocks (as documented in a large literature). An increase in the variance of transitory shocks implies a more concave consumption function with a steeper slope close to the origin, and thus a higher value of aggregate MPC.

Our research builds on the work from a number of streams: (i) measurement of the wealth distribution across countries,[3] (ii) estimation of income dynamics at personal/household level,[4] (iii) empirical work on estimating the MPC[5] and (iv) calibration and solving models with heterogeneity.[6]

The paper proceeds as follows. Section 2 lays out the theoretical model. Section 3 presents key stylized facts on the wealth distribution in the new data from fifteen European countries. Section 4 presents the distribution of the MPCs across countries and households, implied by the model, and summarizes the relationships between the wealth distribution, income dynamics and the MPC. Section 5 concludes.

[1] The Gini coefficient for the US for 2010 of 0.87 exceeds its pre-crisis values for the 1990s and 2000s of roughly 0.8.

[2] Of key importance for wealth inequality is the home-ownership rate; low home-ownership (in countries such as Germany and Austria) implies a high vale of the Gini coefficient (and vice versa).

[3] Systematic cross-country comparisons of the distribution of household wealth are infrequent; see Eurosystem Household Finance and Consumption Network (2013a) for an overview of key stylized facts on the distribution and composition of wealth in our dataset.

[4] See, e.g., Meghir and Pistaferri (2011) for a literature review and Review of Economic Dynamics (2010) for international evidence; see also references in Table 1 of Carroll, Slacalek, and Tokuoka (2013a).

[5] See, e.g., Souleles (2002), Johnson, Parker, and Souleles (2009), Shapiro and Slemrod (2009) and other references in Table 1 of Carroll, Slacalek, and Tokuoka (2013b).

[6] See Krusell and Smith (1998) and Castaneda, Diaz-Gimenez, and Rios-Rull (2003) for seminal contributions.

2 Buffer-Stock Saving Framework With a Realistic Income Process and Modest Heterogeneity in Impatience

2.1 The Model

The model follows closely Carroll, Slacalek, and Tokuoka (2013b) and consists of the following components:

1. *Household income process* $\boldsymbol{y}_t$ ('Friedman/Buffer Stock' income process, FBS) with a permanent (ψ_t) and a transitory (ξ_t) idiosyncratic shock:

$$\begin{aligned} \boldsymbol{y}_t &= p_t \xi_t \mathsf{W}_t, & (1) \\ p_t &= p_{t-1} \psi_t, & (2) \end{aligned}$$

   where W_t denotes the aggregate wage rate. The transitory component is:

$$\begin{aligned} \xi_t &= \mu \text{ with probability } u, \\ &= (1-\tau)\ell\theta_t \text{ with probability } 1-u, \end{aligned}$$

   where $\mu > 0$ is the unemployment insurance payment when unemployed, τ is the rate of tax collected to pay unemployment benefits, ℓ is time worked per employee and θ_t is white noise.

   The motivation for this income process goes back to Friedman (1957). Vast empirical literature (see footnote 4) has since then investigated statistical properties of various measures of income in numerous datasets and concluded that the process (1)–(2) closely resembles the data and that both the transitory and the permanent (or highly persistent) component are important to capture actual income dynamics.

2. *The perpetual-youth mechanism* of Blanchard (1985): To ensure that the ergodic cross-sectional distribution of permanent income exists, households die stochastically with a constant intensity $\mathsf{D} \equiv 1 - \not{\mathsf{D}}$ and are replaced with newborns earning permanent income equal to the population mean. When the probability of dying is large enough, it outweighs the effect of permanent shocks and ensures that the ergodic distribution of income exists (and has a finite variance).[7]

3. *Modest heterogeneity in impatience:* While the FBS process with permanent income shocks substantially improves the model's fit of the empirical wealth distribution, a bit of additional *ex ante* heterogeneity is necessary to ensure an adequate fit (which is important for drawing correct quantitative implications about the MPC). As in the 'β-Dist' model of Carroll, Slacalek, and Tokuoka (2013b), we assume that households in the economy differ in time preference factors β, which are distributed uniformly between $\grave{\beta} - \nabla$ and $\grave{\beta} + \nabla$. We estimate $\grave{\beta}$ and ∇ by fitting the wealth Lorenz curve implied by the model to that in the data:

$$\{\grave{\beta}, \nabla\} = \arg\min_{\{\beta,\nabla\}} \sum_{i\,=\,20,\,40,\,60,\,80} \left(w_i(\beta,\nabla) - \omega_i\right)^2 \qquad (3)$$

[7] Carroll, Slacalek, and Tokuoka (2013a) show that the ergodic cross-sectional distribution of permanent income exists if $\not{\mathsf{D}}\mathbb{E}(\psi^2) < 1$.

subject to the constraint that the aggregate wealth-to-output ratio in the model matches the aggregate capital-to-output ratio from the perfect foresight model.[8] In the above we denote w_i and ω_i the proportion of total wealth held by the top i percent of households in the model and in the data, respectively.

Each household maximizes its lifetime expected discounted CRRA utility:

$$\mathbb{E}_t \sum_{n=0}^{\infty} \beta^n \frac{\boldsymbol{c}_{t+n}^{1-\rho}}{1-\rho}.$$

The household consumption functions $\{\mathrm{c}_{t+n}\}_{n=0}^{\infty}$ satisfy:

$$\begin{aligned}
\mathrm{v}(m_t) &= \max_{\mathrm{c}_t} \ \mathrm{u}(\mathrm{c}_t) + \beta \not{\mathsf{D}} \mathbb{E}_t \left(\psi_{t+1}^{1-\rho} \mathrm{v}(m_{t+1})\right) && (4)\\
&\text{s.t.} \\
a_t &= m_t - c_t, && (5)\\
k_{t+1} &= a_t / (\not{\mathsf{D}} \psi_{t+1}), && (6)\\
m_{t+1} &= (\daleth + r) k_{t+1} + \xi_{t+1}, && (7)\\
a_t &\geq 0, && (8)
\end{aligned}$$

where the variables are divided by the level of permanent income, so that the only state variable is (normalized) cash-on-hand m_t. The three steps (5)–(7) in the evolution of household's market resources account for the probability of dying D, the depreciation factor for capital $\daleth = 1 - \delta$ and the interest rate r, so that the effective interest rate is $(\daleth + r)/\not{\mathsf{D}}$. The production function is Cobb–Douglas, $Z\boldsymbol{K}^{\alpha}(\ell \boldsymbol{L})^{1-\alpha}$, where Z is aggregate productivity, $\boldsymbol{K}$ is capital, ℓ is time worked per employee and $\boldsymbol{L}$ is employment. The wage rate and the interest rate are equal to the marginal product of labor and capital, respectively.

A target wealth-to-permanent-income ratio exists if households are impatient enough in the sense that 'the Death-Modified Growth Impatience Condition' of Carroll, Slacalek, and Tokuoka (2013a) holds.[9]

2.2 Calibration

The model is calibrated at the quarterly frequency following Carroll, Slacalek, and Tokuoka (2013b), Table 3 and the Journal of Economic Dynamics and Control (2010) volume on comparing solution methods for the Krusell and Smith (1998) model.[10]

The calibration and estimation of the model here differs from that in Carroll, Slacalek, and Tokuoka (2013b) in two ways: The distribution of wealth (see section 3 below) and the parametrization of the income process. The estimates of the FBS income process

[8] The capital-to-(quarterly) output ratio is set equal to 10.26 (the value used for the US by Carroll, Slacalek, and Tokuoka (2013b)).

[9] The condition is an amalgam of the discount factor, interest rate, the coefficient of relative risk aversion, expected income growth, the probability of dying and variance of permanent shocks to income; see Appendix C in Carroll, Slacalek, and Tokuoka (2013a).

[10] The model presented here does not include aggregate shocks; see Carroll, Slacalek, and Tokuoka (2013b), who show that aggregate shocks essentially do not affect the model's quantitative implications for the MPC.

Table 1 Estimates of the FBS Income Process in Europe

Income Process: $\boldsymbol{y}_t = p_t\xi_t$, $p_t = p_{t-1}\psi_t$

Country/Authors	Variance of Income Shocks Permanent$^{\bullet}$ σ^2_ψ	Transitory σ^2_ξ	Dataset
France			
Our Calibration	0.010	0.031	
Le Blanc and Georgarakos (2013)*	0.010	0.031	ECHP
Germany			
Our Calibration	0.010	0.05	
Fuchs-Schuendeln, Krueger, and Sommer (2010)‡	0.01–0.096	0.04–0.19	GSOEP
Le Blanc and Georgarakos (2013)*	0.006	0.030	ECHP
Rostam-Afschar and Yao (2013)	0.030	0.054	GSOEP
Yao (2011)§	0.008–0.015	0.07–0.09	GSOEP
Italy			
Our Calibration	0.010	0.075	
Jappelli and Pistaferri (2010)‡	0.02	0.075	SHIW
Le Blanc and Georgarakos (2013)*	0.007	0.105	ECHP
Spain			
Our Calibration	0.010	0.05	
Pijoan-Mas and Sanchez-Marcos (2010)‡	0.01–0.15	~ 0.03	ECPF
Albarran, Carrasco, and Martinez-Granado (2009)$^{\diamond}$	0.015–0.157	0.032–0.162	ECPF/ECHP
Le Blanc and Georgarakos (2013)*	0.001	0.113	ECHP
Other European Countries			
Our Calibration	0.010	0.010	
Memo: United States			
Carroll, Slacalek, and Tokuoka (2013a)	0.010	0.010	Calibrated

Notes: ECHP: European Community Household Panel, GSOEP: German Socio–Economic Panel, SHIW: Survey of Household Income and Wealth, ECPF: Encuesta Continua de Presupuestos Familiares; $^{\bullet}$: For this calibration of other parameters variance of permanent shocks cannot be increased much above 0.01 for the 'Death-Modified Growth Impatience Condition' described in footnote 9 to be satisfied. (Results of section 4.3 below suggest the MPCs implied by the model are quite robust to alternative calibrations of variance of income shocks.) *: See Table 5 in Le Blanc and Georgarakos (2013), ‡: See Table 7A–C in Review of Economic Dynamics (2010), pages 11–13, $^{\diamond}$: See Figures 3 and 4 in Albarran, Carrasco, and Martinez-Granado (2009), page 509. §: Implied by Table 1 in Yao (2011).

for European countries, summarized in Table 1, are much scarcer than for the US; the key contributions are in the Review of Economic Dynamics (2010) volume on 'Cross-Sectional Facts for Macroeconomists' (which reports the evidence from Germany, Italy and Spain). The rows 'Our Calibration' display the values we use.[11]

3 The Wealth Distribution Across and Within Countries

We measure the wealth distribution using data from the Household Finance and Consumption Survey, a new cross-country comparable household-level dataset produced by euro area central banks.[12] The recently released survey provides detailed information on balance sheets of more than 62,000 households from fifteen euro area countries and is thus an ideal source for cross-country comparisons of how various measures and components of wealth are distributed across households.

Figure 2 displays the distribution of wealth-to-permanent income ratios (see also Table 6 in the Appendix). Net wealth is defined as the sum of value of real and financial assets, net of total liabilities. Liquid financial and retirement assets are defined as the sum of value of deposits, mutual funds, non-self-employment business wealth, shares, managed accounts and voluntary private pensions/whole life insurance. We approximate permanent income by restricting the sample to households which in the survey respond that their current income equals roughly to their 'normal' income.

Several facts are relevant for our results below. First, substantial heterogeneity in ratios both across and within countries—up to the multiple of 100 or so of quarterly income—suggests that the MPCs will vary across individual households (because of concavity of the consumption function) and they will imply different reactions of aggregate consumption across countries.

Second, across all countries, the distribution of liquid assets lies substantially closer to zero than the distribution of net wealth, which points toward the hypothesis that a model calibrated to the distribution of liquid assets will imply higher MPCs than a model calibrated to the distribution of net wealth.

Third, the dispersion of the distribution of liquid assets, as reflected, e.g., in the rectangles in Figure 2 showing the interquartile range, is considerably more compressed.

[11] One would hope that the institutional features of individual countries, such as the progressiveness of income taxes and the generosity of unemployment benefits would be more clearly reflected in the estimates of variances of shocks. Table 1 does not point to the fact that, e.g., these variance would be substantially smaller in countries such as Germany. This may be due to measurement and sampling errors.
Blundell, Graber, and Mogstad (2013) document in high-quality administrative data from Norway that the variances of shocks to market (pretax) income clearly exceed those of disposable (after-tax) income. (The Norwegian data also reflect the presence transitory income shocks (as opposed to just measurement error).) See also Rostam-Afschar and Yao (2013) on the effects of the tax and transfer system on precautionary saving.

[12] For more information on the Household Finance and Consumption Survey see the web site, `http://www.ecb.europa.eu/home/html/researcher_hfcn.en.html` and also Eurosystem Household Finance and Consumption Network (2013a) and Eurosystem Household Finance and Consumption Network (2013b).

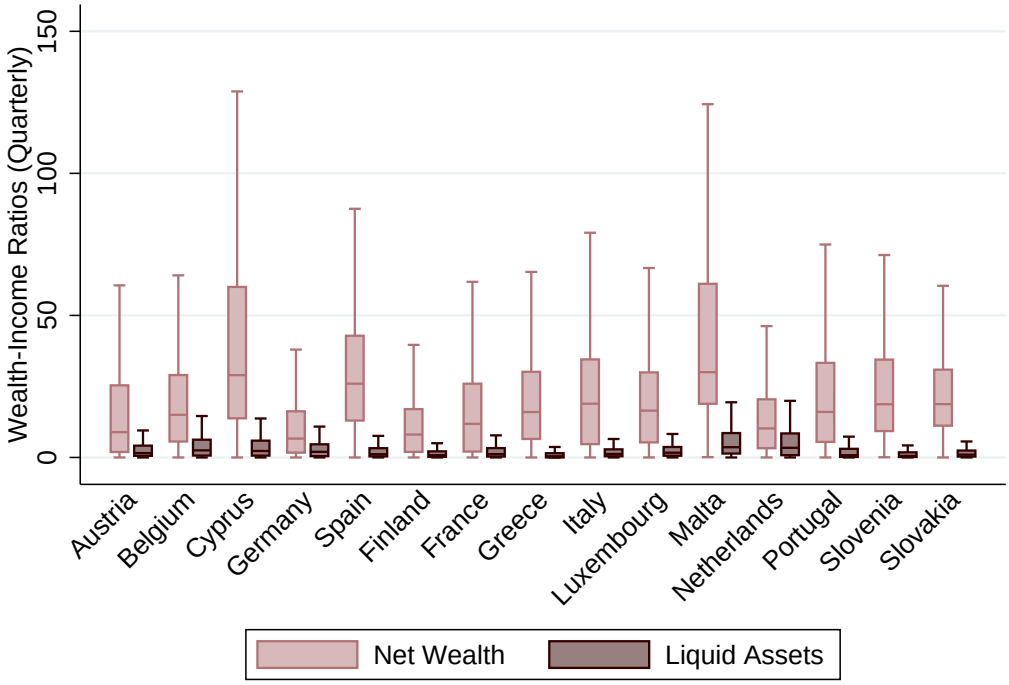
Table 2 Distribution of Wealth-to-Permanent Income Ratios

Statistic	All Countries	Austria	Belgium	Cyprus	Germany	Spain	Finland	France	Greece	Italy	Luxmbrg	Malta	Nethrlds	Portugal	Slovenia	Slovakia
Net Wealth																
10%	1.6	1.5	2.2	6.0	1.2	4.2	1.4	1.5	2.1	2.3	2.2	9.9	1.8	1.8	3.8	6.9
25%	4.2	2.9	6.6	13.9	2.7	13.7	2.9	3.0	7.4	5.6	6.3	19.6	4.1	6.2	10.2	12.1
50%	13.8	9.6	15.6	27.7	7.6	26.9	9.0	12.6	16.9	19.7	17.4	30.5	10.8	16.8	20.4	19.6
75%	27.8	25.1	29.0	52.3	16.9	43.3	17.9	26.5	30.6	34.3	29.9	58.2	20.7	32.9	35.3	31.7
Mean	21.1	20.0	23.7	40.8	13.3	33.7	13.6	20.0	23.9	25.1	24.0	43.0	16.5	25.5	29.5	25.9
Fraction of Households with																
WY$<2^{\star}$	0.14	0.16	0.09	0.04	0.20	0.05	0.17	0.17	0.09	0.08	0.09	0.01	0.12	0.11	0.05	0.02
Gini Coefficient$^{\diamond}$	0.69	0.77	0.61	0.69	0.78	0.58	0.70	0.68	0.56	0.61	0.69	0.61	0.69	0.64	0.55	0.45
Liquid Financial and Retirement Assets																
10%	1.1	1.1	1.1	1.0	1.1	1.1	1.0	1.1	1.0	1.0	1.1	1.4	1.1	1.0	1.0	1.1
25%	1.3	1.5	1.6	1.6	1.3	1.4	1.2	1.3	1.0	1.4	1.5	2.4	1.5	1.2	1.1	1.3
50%	2.2	2.5	3.5	3.2	2.6	2.1	1.7	2.1	1.4	2.2	2.5	4.7	3.6	1.8	1.5	2.0
75%	4.5	4.9	7.0	6.8	5.2	4.1	2.9	4.1	2.4	3.8	4.6	9.4	8.6	3.9	2.8	3.4
Mean	4.3	4.8	7.7	6.8	4.2	4.4	2.9	3.9	2.6	3.3	4.5	7.3	7.3	4.1	2.9	3.3
Fraction of Households with																
LQA–Y$<2^{\star}$	0.45	0.40	0.29	0.33	0.41	0.47	0.60	0.49	0.67	0.45	0.38	0.20	0.34	0.55	0.67	0.50
Gini Coefficient$^{\diamond}$	0.75	0.73	0.76	0.74	0.70	0.80	0.77	0.77	0.81	0.73	0.71	0.59	0.60	0.78	0.77	0.70

Source: The Eurosystem Household Finance and Consumption Survey.

Notes: Ratios to quarterly household income. The table displays only the statistics for households which state that their current income equals roughly to their 'normal' income (variable HG0700 in the survey). The sample is restricted to households with non-negative holdings of net wealth/liquid assets and with the reference person aged 25–60 years. *: Fraction of households with wealth–quarterly income ratio below 2. $^{\diamond}$: Calculated for level of net wealth/liquid assets (not wealth–income ratio).

Figure 2 The Distribution of Wealth-to-Income Ratios Across and Within Countries



Source: The Eurosystem Household Finance and Consumption Survey.

Notes: The figure shows a box plot with the lower adjacent value, the 25th percentile, the median, the 75th percentile and the upper adjacent value. The adjacent values are the 25th percentile − 1.5×interquartile range and the 75th percentile + 1.5×interquartile range. The figure shows only the results for households which state that their current income equals roughly to their 'normal' income (variable HG0700 in the survey). The sample is restricted to households with non-negative holdings of net wealth/liquid assets and with the reference person aged 25–60 years.

4 Marginal Propensity, Wealth Distribution and Income Dynamics

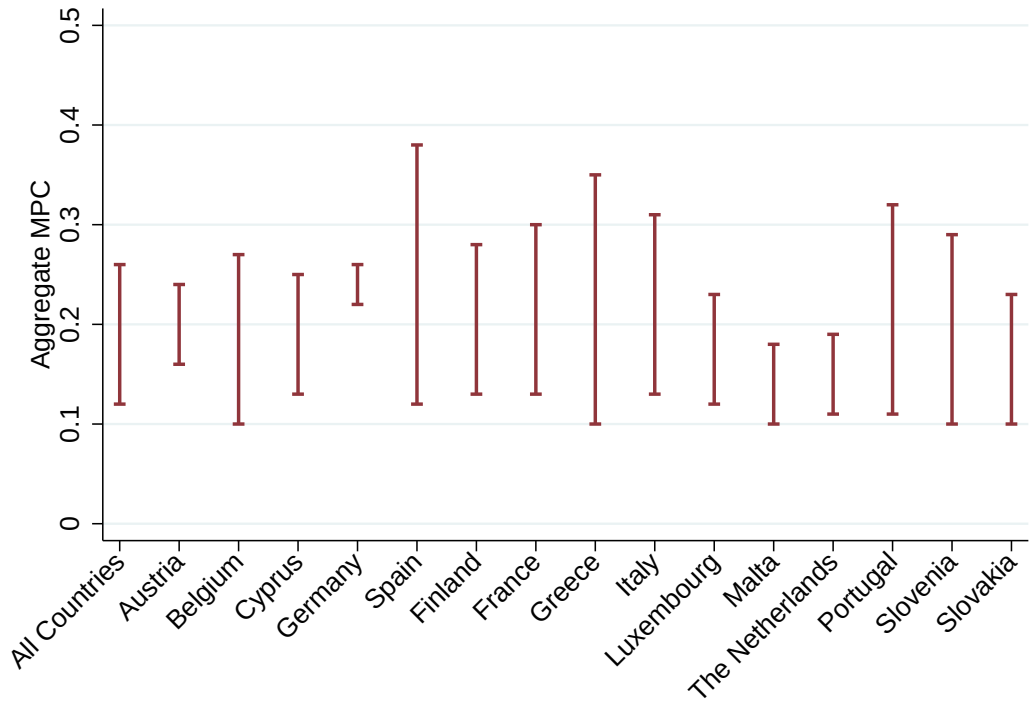
We will now use our model economies to back out quantitatively how the distribution of wealth affects the distribution of the MPC and the reaction of aggregate spending to shocks, such as a 'fiscal stimulus.'

4.1 The Role of the Wealth Distribution

To apply the model of section 2, we alternatively target two wealth variables: net wealth, and liquid financial and retirement assets. These two wealth targets illustrate a range of resources that households can use to smooth adverse shocks.

As argued by Otsuka (2003), Kaplan and Violante (2011) and others, a key factor determining the response of consumer spending is liquidity of assets held by households, i.e., the cost households have to incur if they use their assets to smooth consumption. The model estimated for the distribution of net wealth implicitly assumes that all assets (including housing) are completely liquid, while the model estimated for liquid assets assumes that housing assets are completely illiquid and are not used to smooth

Figure 3 Aggregate MPC: Range Implied by Matching the Distribution of Net Wealth and of Liquid Assets



Notes: The figure shows the range of aggregate MPCs spanned by the estimates based on the distribution of net wealth (lower bound, Table 3) and of liquid assets (upper bound, Table 4).

consumption. A realistic case in which different assets can be rebalanced at different costs (also depending on, e.g., availability and cost of mortgage equity withdrawal across countries) thus likely lies between these two polar cases reported in Tables 3 and 4.

To summarize the tables, the model of section 2 implies the following facts:

1. As also shown in Figure 3, aggregate MPCs range between 0.1 and 0.2 when fitting the distribution of net wealth and roughly between 0.2 and 0.4 when fitting the distribution of liquid assets.[13]

   These estimates are in the lower range of values from numerous empirical studies, which typically find an MPC between 0.2 and 0.6 (investigating mostly various fiscal stimulus episodes in the US).[14] Our model thus implies sharply different conclusions than many other models (including Krusell and Smith (1998)) in which the economy behaves in a certainty-equivalent manner and has aggregate MPCs out of transitory income shocks of 0.02–0.05.

2. The variation in MPCs across individual households generated by concavity of the consumption function is substantial and economically relevant. Spending

[13] We discuss possible determinants of the cross-country variation in MPC below.

[14] Our model fitted to the US wealth distribution implies an aggregate MPC of around 0.2–0.6.

Table 3 The Marginal Propensity to Consume, Matching the Distribution of Net Wealth

	All Countries	Austria	Belgium	Cyprus	Germany	Spain	Finland	France	Greece	Italy	Luxmbrg	Malta	Nethrlds	Portugal	Slovenia	Slovakia
Overall																
Average	0.12	0.16	0.10	0.13	0.22	0.12	0.13	0.13	0.10	0.13	0.12	0.10	0.11	0.11	0.10	0.10
By wealth-to-permanent income ratio																
Top 1%	0.06	0.06	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Top 10%	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Top 20%	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Top 40%	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06
Top 50%	0.06	0.07	0.06	0.06	0.08	0.07	0.06	0.07	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.07
Top 60%	0.07	0.07	0.07	0.07	0.09	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.07
Bottm 50%	0.17	0.25	0.14	0.19	0.34	0.17	0.19	0.19	0.13	0.19	0.17	0.14	0.16	0.15	0.13	0.13
By income																
Top 1%	0.09	0.13	0.07	0.09	0.15	0.07	0.09	0.09	0.07	0.08	0.09	0.07	0.08	0.08	0.07	0.07
Top 10%	0.09	0.13	0.07	0.10	0.16	0.08	0.10	0.10	0.07	0.09	0.09	0.07	0.08	0.08	0.07	0.07
Top 20%	0.10	0.14	0.08	0.11	0.16	0.09	0.11	0.10	0.08	0.09	0.10	0.08	0.09	0.09	0.08	0.08
Top 40%	0.11	0.15	0.10	0.12	0.18	0.10	0.12	0.12	0.09	0.11	0.11	0.10	0.11	0.10	0.09	0.09
Top 50%	0.12	0.16	0.10	0.13	0.19	0.10	0.13	0.12	0.10	0.11	0.12	0.10	0.11	0.11	0.10	0.09
Top 60%	0.12	0.16	0.11	0.13	0.19	0.11	0.13	0.13	0.10	0.12	0.12	0.11	0.12	0.11	0.10	0.10
Bottm 50%	0.12	0.17	0.10	0.13	0.24	0.13	0.13	0.14	0.10	0.15	0.12	0.10	0.11	0.11	0.10	0.10
By employment status																
Employed	0.11	0.15	0.10	0.12	0.20	0.11	0.12	0.12	0.09	0.13	0.11	0.10	0.10	0.10	0.09	0.09
Unempl	0.23	0.33	0.20	0.25	0.38	0.20	0.25	0.24	0.19	0.22	0.23	0.20	0.22	0.21	0.19	0.18
Time preference parameters‡																
$\grave{\beta}$	0.989	0.988	0.990	0.989	0.987	0.990	0.989	0.989	0.990	0.989	0.989	0.990	0.990	0.990	0.990	0.990
∇	0.003	0.005	0.002	0.003	0.007	0.002	0.003	0.003	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.000

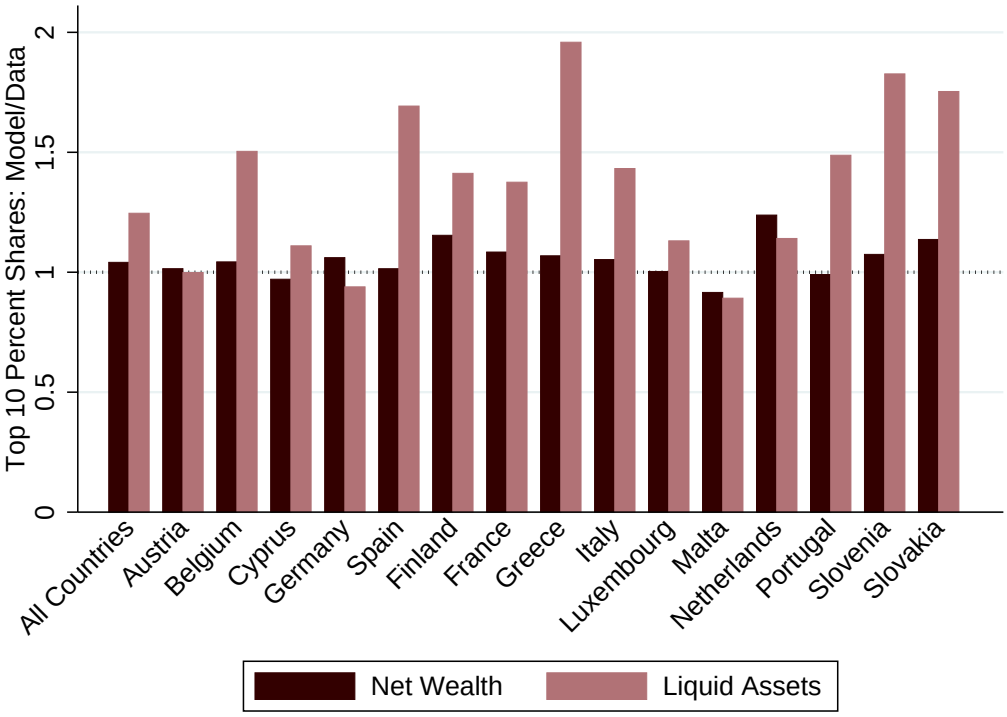
Notes: Average (aggregate) propensities in annual terms. Annual MPC is calculated by $1-(1-\text{quarterly MPC})^4$. ‡: Discount factors are uniformly distributed over the interval $[\grave{\beta}-\nabla, \grave{\beta}+\nabla]$.

Table 4 The Marginal Propensity to Consume, Matching the Distribution of Liquid Financial and Retirement Assets

	All Countries	Austria	Belgium	Cyprus	Germany	Spain	Finland	France	Greece	Italy	Luxmbrg	Malta	Nethrlds	Portugal	Slovenia	Slovakia
Overall																
Average	0.26	0.24	0.27	0.25	0.26	0.38	0.28	0.30	0.35	0.31	0.23	0.18	0.19	0.32	0.29	0.23
By wealth-to-permanent income ratio																
Top 1%	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.12	0.12
Top 10%	0.13	0.13	0.12	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.12	0.12	0.13
Top 20%	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Top 40%	0.13	0.13	0.13	0.13	0.14	0.16	0.14	0.14	0.15	0.15	0.13	0.13	0.13	0.14	0.14	0.13
Top 50%	0.14	0.14	0.14	0.14	0.14	0.18	0.15	0.15	0.17	0.16	0.14	0.13	0.13	0.16	0.15	0.14
Top 60%	0.15	0.15	0.15	0.15	0.15	0.21	0.16	0.17	0.19	0.17	0.14	0.13	0.14	0.18	0.17	0.14
Bottm 50%	0.36	0.33	0.38	0.35	0.36	0.54	0.40	0.43	0.50	0.44	0.32	0.23	0.24	0.45	0.42	0.31
By income																
Top 1%	0.22	0.20	0.22	0.21	0.20	0.29	0.24	0.24	0.30	0.23	0.19	0.15	0.15	0.27	0.25	0.19
Top 10%	0.22	0.20	0.23	0.21	0.20	0.29	0.24	0.24	0.30	0.23	0.20	0.15	0.15	0.27	0.25	0.19
Top 20%	0.23	0.21	0.24	0.22	0.21	0.30	0.25	0.25	0.30	0.24	0.21	0.16	0.17	0.28	0.26	0.20
Top 40%	0.24	0.23	0.25	0.24	0.23	0.32	0.27	0.27	0.32	0.26	0.22	0.18	0.18	0.29	0.27	0.22
Top 50%	0.25	0.24	0.26	0.24	0.24	0.33	0.27	0.28	0.32	0.27	0.23	0.18	0.19	0.30	0.28	0.22
Top 60%	0.25	0.24	0.26	0.25	0.24	0.34	0.28	0.28	0.33	0.28	0.23	0.19	0.19	0.30	0.28	0.23
Bottm 50%	0.27	0.25	0.28	0.26	0.29	0.42	0.30	0.33	0.37	0.35	0.24	0.18	0.19	0.33	0.31	0.23
By employment status																
Employed	0.24	0.23	0.25	0.23	0.25	0.36	0.26	0.28	0.32	0.30	0.22	0.17	0.18	0.29	0.27	0.21
Unempl	0.45	0.42	0.47	0.44	0.41	0.60	0.50	0.51	0.62	0.47	0.40	0.29	0.30	0.57	0.52	0.39
Time preference parameters‡																
$\grave{\beta}$	0.969	0.970	0.969	0.969	0.969	0.964	0.969	0.968	0.966	0.967	0.970	0.971	0.971	0.968	0.968	0.970
∇	0.006	0.005	0.006	0.006	0.006	0.012	0.007	0.008	0.010	0.009	0.005	0.002	0.002	0.008	0.007	0.005

Notes: Average (aggregate) propensities in annual terms. Annual MPC is calculated by $1-(1-\text{quarterly MPC})^4$. ‡: Discount factors are uniformly distributed over the interval $[\grave{\beta}-\nabla, \grave{\beta}+\nabla]$.

Figure 4 Fit of the Models: Ratio of the Share of Top 10 Percent of Households Implied by the Model and in the Data



Source: The Eurosystem Household Finance and Consumption Survey and authors' calculations.

Notes: The figure shows the ratio of the shares implied by the models to those in the data; the values close to one indicate a good fit.

of unemployed individuals and households earning low income and holding little wealth is more sensitive to shocks. This fact implies that a fiscal stimulus targeted to these households has particularly large effects.

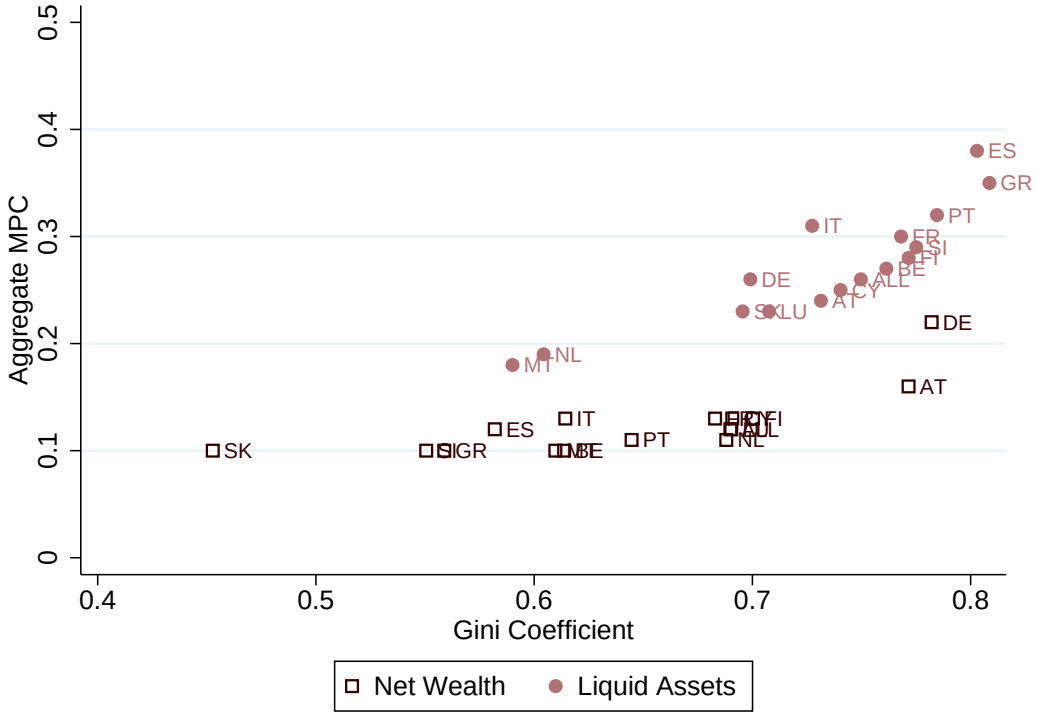
This finding is again broadly in line with a number of empirical studies, such as Blundell, Pistaferri, and Preston (2008), Broda and Parker (2012), Kreiner, Lassen, and Leth-Petersen (2012) and Jappelli and Pistaferri (2013).

3. The estimates of the discount factor β lie around 0.99 for net wealth and 0.97 for liquid assets. The extent of heterogeneity in β is very modest: $\nabla \approx 0.003$ and $\nabla \approx 0.006$ for net wealth and liquid assets, respectively. These values are roughly half the size of those reported in Carroll, Slacalek, and Tokuoka (2013b) for the US ($\nabla \approx 0.006$–0.013), reflecting the lower wealth inequality in European countries.

4. Figure 4 illustrates how the model fits the upper tail of the wealth distribution. The figure shows the ratio of the share of wealth held by the top 10 percent of households living in the model to those living in the real world.[15] The ratios typically lie close

[15] Note that the top 10 percent share is *not* targeted in the estimation of $\grave{\beta}$ and ∇ in equation (3) above, so that the statistics in Figure 4 have a bit of an 'out-of-sample' flavor.

Figure 5 How Wealth Inequality Affects Aggregate MPC: The Gini Coefficients and the Aggregate MPC



Source: The Eurosystem Household Finance and Consumption Survey and authors' calculations.

to 1, suggesting the model performs quite well, although it overfits the upper tail of liquid assets in a few countries.[16]

4.2 Wealth Inequality and Aggregate MPC: Cross-Country Results

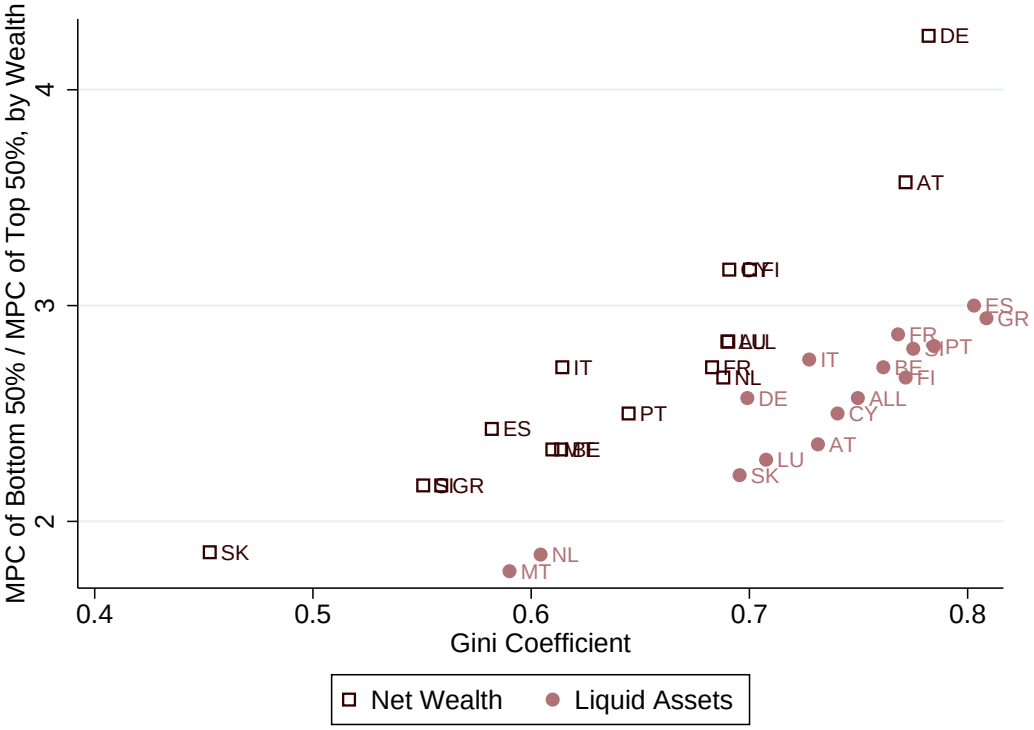
An important advantage of datasets with a large country dimension, such as the Household Finance and Consumption Survey, is that they make it possible to compare economic behavior of households across countries. This section investigates how differences in wealth distributions across countries affect the response of economies to shocks.[17]

Figure 5 summarizes the relationship between wealth inequality (as measured with the Gini coefficient) and aggregate MPCs (reported in row 1 of Tables 3 and 4). For both measures of wealth, countries with more unequal wealth distributions tend to have a higher proportion of households with little wealth and tend to respond more strongly

[16]Note that for our purpose of backing out the aggregate MPC it is not vital to match *the upper tail* of the wealth distribution perfectly, as the consumption function is approximately linear at the higher levels of wealth, above the median or so.

[17]While we assume the wealth distribution is exogenous, in reality, it depends on institutions and policies. For example, as mentioned in footnote 2, an important factor for wealth inequality is the home-ownership rate, which further depends on institutions, such as the size of downpayment ratios, see Chiuri and Jappelli (2003).

Figure 6 How Wealth Inequality Affects Inequality in MPC



Source: The Eurosystem Household Finance and Consumption Survey and authors' calculations.

Notes: The figure shows the Gini coefficient for wealth against the ratio of the MPC for bottom and top 50 percent of households by wealth-to-permanent income ratio.

to shocks.[18] The relationship is tighter for liquid assets as these holdings are lower than holdings of net wealth and the consumption function is more concave (and steeper) close to the origin.

Figure 6 displays the relationship between wealth inequality and heterogeneity across MPCs (as captured in the ratio of average MPCs of the top and bottom half of households by wealth). For both measures of wealth, the figure documents that wealth inequality affects not only the level of aggregate MPC but also the dispersion of MPCs across individual households in the economy. Given the shape of the consumption function, more pronounced wealth inequality increases the proportion of households with little wealth and the MPC among the lower half of the population, while it does not affect the MPC of the upper half, as the consumption function is essentially linear in that region. The relationship is again tighter for liquid assets.

Table 5 The MPC Under Alternative Variances of Income Shocks

Scenario	Baseline $\sigma^2_\psi = 0.01$ $\sigma^2_\theta = 0.01$	Low σ^2_ψ $\sigma^2_\psi = 0.005$ $\sigma^2_\theta = 0.01$	High σ^2_θ $\sigma^2_\psi = 0.01$ $\sigma^2_\theta = 0.05$	Very High σ^2_θ $\sigma^2_\psi = 0.01$ $\sigma^2_\theta = 0.10$
Overall				
Average	0.12	0.12	0.14	0.17
By wealth-to-permanent income ratio				
Top 1%	0.06	0.06	0.06	0.06
Top 10%	0.06	0.06	0.06	0.06
Top 20%	0.06	0.06	0.06	0.06
Top 40%	0.06	0.06	0.06	0.07
Top 50%	0.07	0.07	0.05	0.07
Top 60%	0.07	0.06	0.07	0.08
Bottom 50%	0.17	0.17	0.22	0.26
By income				
Top 1%	0.09	0.08	0.10	0.11
Top 10%	0.09	0.09	0.10	0.12
Top 20%	0.10	0.10	0.11	0.12
Top 40%	0.11	0.11	0.12	0.14
Top 50%	0.12	0.11	0.12	0.14
Top 60%	0.12	0.11	0.13	0.15
Bottom 50%	0.12	0.13	0.16	0.20
By employment status				
Employed	0.11	0.11	0.14	0.16
Unemployed	0.23	0.24	0.25	0.27
Time preference parameters‡				
$\grave{\beta}$	0.989	0.990	0.989	0.988
∇	0.003	0.002	0.004	0.005

Notes: Average (aggregate) propensities in annual terms. Annual MPC is calculated by $1-(1-\text{quarterly MPC})^4$. ‡: Discount factors are uniformly distributed over the interval $[\grave{\beta}-\nabla, \grave{\beta}+\nabla]$. The targeted wealth distribution is the distribution of net wealth for the full sample covering all fifteen countries.

4.3 The Role of Income Shocks

Table 1 above summarized empirical estimates of the FBS income process (1)–(2). Although in principle variance of income shocks should be related to institutional features at the country level, such as progressivity of the tax system and generosity of social benefits, empirical estimates do not seem to reflect this clearly enough.

For that reason, Table 5 presents a comparative statics exercise about the role of the size of income shocks, comparing the baseline calibration of Table 3 (for 'all countries') to three alternatives which differ in the variance of permanent and transitory shocks.[19]

While the size of permanent income shocks affects the shape of the consumption function only negligibly, empirically plausible variation in the variance of transitory shocks generates quite substantial changes in the MPC for the whole economy and, in particular, for households with little wealth. Larger transitory shocks make the consumption function steeper close to the origin. Specifically, an increase in σ_θ^2 from 0.01 to 0.1 raises the average MPC from 0.13 to 0.17 for the whole population and from 0.19 to 0.26 for the lower 50 percent of households by wealth.

5 Conclusions

Our results document the importance of matching stylized facts at the household level for thinking about the reaction of economies to shocks. The precautionary saving motive generates a concave consumption function, which means that the reaction of spending of individual households depends on the level of wealth they hold. Due to this substantial non-linearity, to draw correct quantitative conclusions about the aggregate behavior of the economy, it is important that the model fits the empirical wealth distribution. Using data from fifteen European countries, we find that wealth inequality and differences in the dynamics of household income affect the response of economies to a 'fiscal stimulus' in an economically relevant way.

[18] Table 2 above documents a strong relationship between the Gini coefficient and the proportion of households with wealth-to-permanent income ratio below 2.

[19] Note that the variance of permanent shocks σ_ψ^2 cannot be increased if, for the calibration with liquid assets, all households are to meet the condition of footnote 7, which ensures that the ergodic distribution of income exists.

References

Albarran, Pedro, Raquel Carrasco, and Maite Martinez-Granado (2009): "Inequality for Wage Earners and Self-Employed: Evidence from Panel Data," *Oxford Bulletin of Economics and Statistics*, 71(4), 491–518.

Blanchard, Olivier J. (1985): "Debt, Deficits, and Finite Horizons," *Journal of Political Economy*, 93(2), 223–247.

Blundell, Richard, Michael Graber, and Magne Mogstad (2013): "Labor Income Dynamics and the Insurance from Taxes, Transfers, and the Family," mimeo, University College London.

Blundell, Richard, Luigi Pistaferri, and Ian Preston (2008): "Consumption Inequality and Partial Insurance," *American Economic Review*, 98(5), 1887–1921.

Broda, Christian, and Jonathan A. Parker (2012): "The Economic Stimulus Payments of 2008 and the Aggregate Demand for Consumption," mimeo, Northwestern University.

Carroll, Christopher D., Jiri Slacalek, and Kiichi Tokuoka (2013a): "Buffer-Stock Saving in a Krusell–Smith World," mimeo, Johns Hopkins University.

——— (2013b): "The Distribution of Wealth and the Marginal Propensity to Consume," mimeo, Johns Hopkins University.

Castaneda, Ana, Javier Diaz-Gimenez, and Jose-Victor Rios-Rull (2003): "Accounting for the U.S. Earnings and Wealth Inequality," *Journal of Political Economy*, 111(4), 818–857.

Chiuri, Maria Concetta, and Tullio Jappelli (2003): "Financial Market Imperfections and Home Ownership: A Comparative Study," *European Economic Review*, 47(5), 857–875.

Eurosystem Household Finance and Consumption Network (2013a): "The Eurosystem Household Finance and Consumption Survey – First Results," Statistics Paper Series 2, European Central Bank, http://www.ecb.europa.eu/pub/pdf/other/ecbsp2en.pdf.

——— (2013b): "The Eurosystem Household Finance and Consumption Survey – Methodological Report," Statistics Paper Series 1, European Central Bank, http://www.ecb.europa.eu/pub/pdf/other/ecbsp1en.pdf.

Friedman, Milton A. (1957): *A Theory of the Consumption Function*. Princeton University Press.

Fuchs-Schuendeln, Nicola, Dirk Krueger, and Mathias Sommer (2010): "Inequality Trends for Germany in the Last Two Decades: A Tale of Two Countries," *Review of Economic Dynamics*, 13(1), 103–132.

Jappelli, Tullio, and Luigi Pistaferri (2010): "Does Consumption Inequality Track Income Inequality in Italy?," *Review of Economic Dynamics*, 13(1), 133–153.

——— (2013): "Fiscal Policy and MPC Heterogeneity," discussion paper 9333, CEPR.

Johnson, David S., Jonathan A. Parker, and Nicholas S. Souleles (2009): "The Response of Consumer Spending to Rebates During an Expansion: Evidence from the 2003 Child Tax Credit," working paper, The Wharton School.

Journal of Economic Dynamics and Control (2010): "Computational Suite of Models with Heterogeneous Agents: Incomplete Markets and Aggregate Uncertainty," *edited by Wouter J. Den Haan, Kenneth L. Judd, Michel Juillard*, 34(1), 1–100.

Kaplan, Greg, and Giovanni L. Violante (2011): "A Model of the Consumption Response to Fiscal Stimulus Payments," *NBER Working Paper Number W17338*.

Kreiner, Claus Thustrup, David Dreyer Lassen, and Søren Leth-Petersen (2012): "Heterogeneous Responses and Aggregate Impact of the 2001 Income Tax Rebates," discussion paper 9161, CEPR.

Krusell, Per, and Anthony A. Smith (1998): "Income and Wealth Heterogeneity in the Macroeconomy," *Journal of Political Economy*, 106(5), 867–896.

Le Blanc, Julia, and Dimitris Georgarakos (2013): "How Risky Is Their Income? Labor Income Processes in Europe," mimeo, Goethe University Frankfurt.

Meghir, Costas, and Luigi Pistaferri (2011): "Earnings, Consumption and Life Cycle Choices," in *Handbook of Labor Economics*, ed. by O. Ashenfelter, and D. Card, vol. 4, chap. 9, pp. 773–854. Elsevier.

Otsuka, Misuzu (2003): "Household Portfolio Choice with Illiquid Assets," manuscript, Johns Hopkins University.

Pijoan-Mas, Josep, and Virginia Sanchez-Marcos (2010): "Spain Is Different: Falling Trends of Inequality," *Review of Economic Dynamics*, 13(1), 154–178.

Review of Economic Dynamics (2010): "Cross-Sectional Facts for Macroeconomists," 13(1), 1–264, edited by Dirk Krueger, Fabrizio Perri, Luigi Pistaferri, Giovanni Luca Violante.

Rostam-Afschar, Davud, and Jiaxiong Yao (2013): "Taxation and Precautionary Savings over the Life Cycle," mimeo.

Shapiro, Matthew W., and Joel B. Slemrod (2009): "Did the 2008 Tax Rebates Stimulate Spending?," *American Economic Review*, 99(2), 374–379.

Souleles, Nicholas S. (2002): "Consumer Response to the Reagan Tax Cuts," *Journal of Public Economics*, 85, 99–120.

Yao, Yao (2011): "Labor Income Risks in Germany," mimeo, University of Mannheim.

Appendix: Additional Statistics on the Wealth Distribution

Table 6 displays statistics about the distribution of net wealth, and liquid financial and retirement assets across countries. The last row shows the number of observations in the sample (which is restricted to households with the reference person aged 25–60 years).

Table 6 Proportion of Wealth Held by Percentile of Households (in Percent)

Statistic	All Countries	Austria	Belgium	Cyprus	Germany	Spain	Finland	France	Greece	Italy	Luxmbrg	Malta	Nethrlds	Portugal	Slovenia	Slovakia
Net Wealth																
Top 1%	19.0	23.7	13.6	19.4	28.9	14.7	14.0	16.5	8.4	13.3	25.4	26.9	8.7	17.1	9.1	7.9
Top 10%	51.3	61.5	43.7	56.8	63.3	43.1	48.0	49.5	38.3	44.3	53.3	50.3	41.1	48.8	38.4	33.3
Top 20%	68.6	77.3	61.2	71.9	79.2	59.5	68.0	67.7	56.3	61.5	69.1	63.6	62.9	65.0	57.5	49.3
Top 40%	88.9	93.6	83.6	87.4	94.2	80.2	90.7	89.2	79.7	83.4	87.6	80.7	89.5	84.9	79.8	71.5
Top 60%	98.1	99.4	95.9	95.5	99.3	93.1	100.1	98.5	93.9	96.1	97.6	92.0	101.8	95.8	93.3	86.7
Top 80%	100.4	100.6	99.9	99.6	100.5	99.7	101.7	100.2	99.8	99.7	100.1	98.6	104.9	100.0	99.4	96.9
Liquid Financial and Retirement Assets																
Top 1%	21.8	20.9	27.4	22.9	16.4	29.6	29.1	26.8	20.4	20.7	18.3	8.4	8.6	20.1	18.8	13.4
Top 10%	59.9	58.6	62.8	60.9	53.1	69.0	65.1	64.1	69.0	57.2	55.8	39.3	39.1	65.4	62.6	52.5
Top 20%	77.3	75.3	78.1	76.0	71.3	83.3	80.0	79.4	84.4	74.6	72.8	60.0	60.3	82.6	80.7	72.2
Top 40%	92.9	91.0	92.7	91.2	90.1	94.8	92.8	93.0	96.4	91.4	90.0	83.8	85.3	94.9	95.1	90.4
Top 60%	98.3	97.4	98.2	97.8	97.8	98.7	97.9	98.1	99.6	97.8	97.3	95.0	96.4	98.8	99.4	97.3
Top 80%	99.8	99.7	99.9	99.9	99.8	99.9	99.7	99.7	100.0	99.9	99.8	99.4	99.6	99.8	100.0	99.6
# Obs	36854	1500	1387	976	2044	3102	6697	8648	2066	4257	692	492	743	2409	216	1625

Source: The Eurosystem Household Finance and Consumption Survey.

Notes: The sample is restricted to households with the reference person aged 25–60 years.